Kitzmiller’s Tenth Anniversary: How the Scientific Case Might be Updated

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I’ll admit it. The whole Kitzmiller v Dover thing was my fault. Well, at least half my fault. My coauthor, Joe Levine, deserves a big share of the blame as well, since he’s the one who actually wrote most of the evolution section of our biology textbook. As the teachers at Dover High School will tell you, it was their preference for our book that started everything back in 2004. In the spring of that year, a sales representative for my publisher called me to let me know that the teachers in a small town in eastern Pennsylvania had selected our textbook, which I took as good news. But there is going to be a problem with the local school board, she warned, and it has to do with evolution.

Having dealt with this sort of thing before, I figured I’d take it on directly. I called the Dover Area superintendent, introduced myself, and volunteered to talk directly to any members of the board who had issues with our book. When I’d done this sort of thing in the past, the administrator typically let loose with a sigh of relief, hoping I could soothe the troubles and calm his anxious board members. Not so in Dover. The superintendent thanked me, but quickly made it clear that he wanted absolutely no help from me. “Don’t call us—we’ll call you,” was how he ended the conversation. I knew right away that something strange was going on.

With the help of a little internet searching, I found the name of Bertha Spahr, the science department chair at Dover High School, and managed to get her on the phone. She explained the situation in blunt language. The Dover board is dominated by an anti-evolution majority, she said, and they are going to force “intelligent design” (ID) on us as a condition of adopting your textbook. “How can I help?” I asked. The political situation was such, she explained, that the best thing I could do for now was to stay out of it, and hope the board would come to its senses. As we both soon learned, it wouldn’t. The board forced the issue, and the Kitzmiller v Dover lawsuit was filed on December 14, 2004.

Preparing for Trial

Early in 2005 I was contacted by an attorney from Philadelphia, Eric Rothschild, who asked whether I might be willing to serve as an expert witness in the upcoming trial. I said “yes,” and when I traveled to Philadelphia in March for a scientific meeting, I had dinner with Eric and the team of his colleagues from Pepper Hamilton who had taken on the case. While the food was great (these corporate lawyers really do know the best restaurants!), the conversation sent me into a tailspin. These guys were clueless. They didn’t know RNA from DNA, they’d never heard of punctuated equilibrium, and they thought Hardy-Weinberg was a competing law firm somewhere in western Pennsylvania. I was bummed out,
figuring that this legal team was hopelessly ignorant of the questions we’d have to answer and the technical ground over which the legitimacy of ID would be tested. I was certain that the trial was not going to go well, and wondered if I should have agreed so quickly without knowing anything about the competence of the lawyers. I consoled myself by thinking that at least there might be a certain kind of honor to be gleaned from fighting the good fight, even if the battle would surely be lost.

I’ve seldom been so completely wrong about anything.

In the spring I prepared an “expert statement,” outlining my own area of expertise and highlighting what I hoped to be able to say in court regarding evolution and the Dover ID policy. The Thomas More Legal Center, representing the board, had full access to that statement, and on May 25, 2005, one of their attorneys (Robert Muise) came to Providence to depose me as part of the pre-trial preparation. That’s when my opinion of our attorneys started to change. Vic Walczak, from the Pennsylvania ACLU, came along to serve as my counsel during the deposition. Throughout this nine-and-a-half-hour ordeal, Vic was amazing. He was well prepared, he knew my expert statement backwards and forwards, and he deflected inappropriate or misleading questions with the skill of a courtroom expert. It was the beginning of a beautiful friendship.

Vic made two more trips to Providence that summer as we laid the groundwork for my testimony in the trial. I still have the notes from those meetings as we considered various lines of questioning and my likely responses. Vic patiently made it clear that my testimony, as I had planned it, would be far too technical, and would likely have little effect on the court. Remember, he explained, this case is being heard by a judge with plenty of legal training, but quite possibly with very little scientific background. You can count on that judge to understand the science, Vic told me, but only if you provide a bridge that will take him, step by step, to where you want to go. “You’ve got to put in terms so simple that even a lawyer would be able to understand them.” So that’s exactly what we set out to do.

**Planning the testimony**

Eric Rothschild had told me that one of the reasons he wanted me as a witness was my experience in debating issues of creation science and ID with the likes of Henry Morris, Duane Gish, and even Michael Behe. So I had originally thought of the upcoming trial as a kind of debate, with the judge keeping score. But Vic explained that a “debate” was not the right model for what should unfold in the courtroom. Ideally, it should be more like a series of seminars in which evidence was presented in clear and understandable fashion, gradually building towards a definitive conclusion we hoped the court would share. Vic convinced me that we had three very distinct but interrelated tasks to carry out during the opening days of the trial.

The first of these was to explain the case for evolution. We needed to show how robust the evidence for common descent was, demonstrate the fact that it was generally accepted by the scientific community, and then explain how that evidence was presented in our textbook for students. In my view, our textbook gave the best, clearest, and most up-to-date summary of the scientific consensus on evolution available, and we needed to make sure the judge knew that had indeed been our goal as we wrote and illustrated the text.
Next was something that, in retrospect, was critical for the ultimate outcome of the trial. Although I had debated Michael Behe several times in previous years, I was not going to be able to debate him directly at the trial. In fact, Behe’s testimony was going to follow my own by several weeks. So it was critical that I explain to the judge, in advance, exactly what Behe’s testimony was likely to be, and how it was linked to the ID textbook the board had chosen, Of Pandas and People. We realized that if I were to do this unfairly or to misrepresent the arguments for ID, the whole credibility of our case would be compromised. So we had to get this right. That meant plenty of work rereading both Pandas and Darwin’s Black Box, as well as the preparation of slides showing Behe’s arguments around such icons of ID as the bacterial flagellum, the immune system, and the blood clotting cascade.

Finally, after carefully presenting what Behe and Pandas said about ID and evolution, I would have to explain, well in advance of Behe’s own testimony, why these arguments were wrong. In effect, our goal was to prepare the judge for what would come when the board got to present its defense, and make sure the judge already knew the flaws, errors, and misrepresentations that riddled the case for ID. From there, our case would move on to other experts familiar with the philosophical aspects of ID (the territory of Rob Pennock), the religious nature of the idea (John Haught), its effect on science education (Brian Alters), and the very revealing history of the ID strategy, expertly documented by the incomparable Barbara Forrest. Our last expert witness, Kevin Padian, would bring the judge back to science by focusing on the fossil record.

I figured all was in order, and we were fully prepared. However, our attorneys insisted I arrive at Harrisburg three days before the opening gavel. Why? “Is this really necessary?” I pleaded. They insisted and used the three days to put me through a series of simulated cross-examinations at their offices. It was there I discovered that NCSE had been working tirelessly with the legal team, and helping them grasp the scientific, political, and historical issues on which the case would surely turn. As a result, these previously clueless attorneys had mastered the science of the case so thoroughly that I felt as though I were being grilled by members of the National Academy of Sciences. Clearly, they were more than ready—and so was I.

How well did the team succeed? Judging from the final written decision, we made the case pretty well. As an example, here’s what Judge Jones wrote about ID arguments invoking “irreducible complexity”:

As irreducible complexity is only a negative argument against evolution, it is refutable and accordingly testable, unlike ID, by showing that there are intermediate structures with selectable functions that could have evolved into the allegedly irreducibly complex systems. (2:15-16 (Miller)). Importantly, however, the fact that the negative argument of irreducible complexity is testable does not make testable the argument for ID. (2:15 (Miller); 5:39 (Pennock)). Professor Behe has applied the concept of irreducible complexity to only a few select systems: (1) the bacterial flagellum; (2) the blood-clotting cascade; and (3) the immune system. Contrary to Professor Behe’s assertions with respect to these few biochemical systems among the myriad existing in nature, however, Dr Miller presented evidence, based upon peer-reviewed studies, that they are not in fact irreducibly complex. (Kitzmiller v Dover, page 76 of the slip opinion; page 740 of the official version)
Judge Jones had clearly grasped our scientific arguments. His opinion went on to dismantle one ID argument after another, until it was clear that the board’s disingenuous plea of scientific relevance was hopeless. Headlines in newspapers after the decision proclaimed “Judge Rules Intelligent Design is not Science,” exactly the point we sought to make. Even more importantly, the testimony established conclusively that ID was in fact a religious idea, a kind of reformulated scientific creationism, in which the description of the creator had merely been changed to “Designer,” but which nonetheless betrayed the frankly religious intent of its sponsors and advocates. From there, our legal dream team, including Steve Harvey along with Eric and Vic, did the rest. As Vic was to tell me in an excited phone call the morning of the decision, “We hit a home run. No, wait a minute. We hit a grand slam!” What else could you say about a court case that produced four books and two movies, and profoundly changed the landscape of science teaching in America?

**Updating the Science of Kitzmiller**

If we were to try the case again today, my testimony regarding the nature of scientific theories and the need for testability would be almost unchanged. So too would be the
description of Joe Levine's and my motivations as science educators and authors, and also of the need for curriculum and content to reflect the scientific mainstream. But in many respects, the science of the last ten years would make possible an even more compelling case for evolution.

How would that go? Well, I’d open my testimony by looking at the “progress” of the ID movement in the last decade. My remarks would be brief, because to put it frankly, there hasn’t been any. Behe’s supporters are still repeating their hopeless arguments about the bacterial flagellum, of course, but to little effect. To be fair, Behe himself has tried to marshal some new statistical arguments to make the case that above a certain level of complexity, outside intelligence is required to assemble complex biochemical systems. But in so doing, he’s found himself unable to avoid conclusions that surely trouble his fundamentalist supporters. Faced with the reality that many gruesome pathogens are indeed too complex to be the products of evolution (according to his analysis), he’s thrown up his hands and stated that they, too must be the work of the Designer. So what does one say of a supposedly benevolent designer whose fine works include smallpox, polio, and tuberculosis? Not much, except to quote the Jewish proverb, as Behe did in his book *The Edge of Evolution*, “If God lived in the village, people would break his windows.” When this book appeared in 2007, it was the subject of reviews in *Nature*, *Science*, and *The New York Times*. Having your work reviewed in these three publications would be good news for most authors. Not so for Behe. The reviewers were, respectively, myself (2007), Sean B Carroll (2007), and Richard Dawkins (2007). Needless to say, Behe’s new arguments fared no better than the old ones.

Along those lines, during the 2005 trial, I had dealt with the infamous bacterial flagellum in three steps. First, I explained why an irreducibly complex system was “unevolvable,” at least according to Behe. The reason is because, as he put it, “any irreducibly complex system that is missing a part is, by definition, nonfunctional”—evolution cannot assemble a few nonfunctional components of such a system in the hopes that eventually they would become functional. Next, I proposed a way to test Behe’s hypothesis, which would involve taking a few parts away from the flagellum and seeing if what is left would be functional in any sense that might be favored by natural selection. Finally, I pointed out that nature had already carried out that exact experiment. Take away nearly thirty proteins from the standard bacterial flagellum, and what are you left with? A transmembrane complex known as the Type III secretion system that is fully functional and homologous to a subset of proteins in the flagellum. Case closed—these parts of a supposedly irreducibly complex system are indeed functional, contradicting the core of the argument.

The same analysis would still hold true today, but it could be made in much greater detail, including new insights as to the actual evolution of systems such as the flagellum. Wong and others (2007) cited evidence from several laboratories to propose that the flagellum derived from an “ancestral secretion system that used ATP and an ATPase to drive protein export.” In 2010, Edward Engelman at the University of Virginia summarized a decade of genetic and biochemical work to describe what he called the “reducible complexity” of the flagellum, demonstrating that it was clearly the product of evolutionary mechanisms that had developed the complex system from simpler parts, and then co-opted them for new functions (Engelman 2010). Most recently, Ibuki and others (2011) demonstrated deep ho-
mologies between parts of the flagellum and the ATP synthetase enzyme used in metabolic pathways that are nearly universal among living cells.

In 2005, the core of my argument against irreducible complexity was that the parts of a supposedly irreducibly complex system arise from simpler systems with functions of their own. In my testimony I was able to cite only the Type III secretory system as an example of such a system. Today, I would have many more examples to choose from.

Noting that even Judge Jones seemed to grow weary of the flagellum as it was repeatedly cited by ID witnesses, my prime example of the failure of “design” arguments today might well be the blood clotting cascade. My testimony had pointed out examples of living organisms in which one or two parts of this complex system were missing, and yet blood clotting was fully functional. As effective as these examples may have been, today the story is far more complete. The groundbreaking work of Russell Doolittle not only has expanded the list of organisms with “missing” parts of this supposedly irreducible system, but also has shown where the individual parts of the system originated by studies of primitive chordates. Doolittle has summarized this work in his book *The Evolution of Blood Clotting* (2012). Were I to take the stand again today, I’d be reading chapter and verse from Doolittle, comparing it gleefully to the nonsense in *Pandas*.

Finally, at the risk of spending even more time on the stand, and straining the patience of the court with yet another “lecture,” I’d bring two more research studies into the case for evolution. The first of these would cite the remarkable studies of Richard Lenski, a colleague of Rob Pennock’s at Michigan State. For more than a quarter of a century, Lenski has maintained multiple cultures of *E. coli* bacteria in his laboratory, allowing evolution to take its course without outside interference, and certainly without “design.” His lab has carefully analyzed a series of genetic changes that have occurred in the cultures, including an evolutionary “innovation” that allowed one of the cultures to use citrate as a food source (see, for example, Blount and others 2008). Since *E. coli* is defined as a species by its inability to metabolize citrate, this amounts to the emergence of a new species under controlled laboratory conditions, a powerful demonstration of both historical contingency and of the capacity of genetic mechanisms to drive speciation at the most basic level.

The studies of Joe Thornton, now at the University of Chicago, would likely conclude my 2015 testimony. I’d have to work to distill the sophisticated nature of Joe’s studies into the kind of language Vic would demand (so even an attorney could understand it!), but it would be worth the effort. Joe’s techniques have led to ways to trace the ancestral routes by which proteins evolve new and novel functions, something the advocates of design claim to be impossible. Nonetheless, Thornton’s careful work has shown exactly how such functions did evolve, following evolutionary mechanisms that confirm the contingent and unpredictable nature of evolutionary change (for a summary of Thornton’s work, see Pearson 2012). The elegance of Lenski’s and Thornton’s work would make for a dramatic contrast to the failed claims and unproductive sterility of the argument for design.

**Kitzmiller v Dover in Retrospect**

The Discovery Institute and other critics of evolution were quick to pin the decisive nature of the *Kitzmiller* decision on an “activist judge” and a failed legal strategy on the part of the Thomas More Legal Center. Many of their writings and web postings have implied that
our case against ID was flawed, and that they would surely prevail if a similar case were tried again. In the years after the trial, however, the compelling nature of the case put together by the Kitzmiller team had effects well beyond the middle district of Pennsylvania. In Ohio, the state board of education decided, just a few months after the trial, to scrap an ID-inspired model lesson plan on evolution. Then, as attorneys for the Cobb County School District in Georgia prepared for a retrial of Selman v Cobb County, a case involving evolution “warning” stickers, they received a shock. If they chose to go ahead with a retrial after the appellate court had returned the case to the district level, they would face “the full Kitzmiller.” Eric Rothschild and Richard Katskee (of Americans United for Separation of Church and State) had solicited expert statements from several of the Kitzmiller witnesses, and made it clear that Cobb County would face the same legal and scientific team that had prevailed in Pennsylvania. In December 2006, Jeffrey Selman and the other plaintiffs prevailed in an out-of-court settlement, and a retrial was avoided. Score another victory for the Kitzmiller team.

I think it’s also fair to say that the Kitzmiller experience has emboldened science educators, textbook authors, and even publishers. The Next Generation Science Standards now considered as models for state science education standards are very strong on evolution, and this has resulted in increased emphasis on evolutionary principles in many schools and classrooms. All of the textbooks from major publishers now present evolution as the central principle of biology, perhaps helping to explain why acceptance of evolution is now so high among younger population groups in the United States. According to a 2015 study by the Pew Research Center, 73% of Americans aged 18–29 agree with the statement that “humans and other living things have evolved over time,” the highest level of support among any age group (Pew Research Center 2015:90). Joe Levine and I have done our best to support that trend, hoping to live up to the high standard that provoked William Buckingham of the Dover Area School Board to complain that our 2004 textbook was “laced with Darwinism” from cover to cover. We are confident that he would find even more to object to in our latest edition.

As the years have gone by, I think that all of us who had the good fortune to be swept up in the trial have realized just how lucky we were to play our parts in the drama. While the case was argued publicly by attorneys in open court, NCSE’s work behind the scenes was surely the key ingredient to ultimate success. This was a very special struggle, and those of us who came from across the nation to testify or to work with the Kitzmiller team will remain forever in the debt of those who made the trial possible. I refer, of course, to the eleven courageous plaintiffs and their families who stood up for principle and braved the criticism, slander, anger, and even worse from neighbors and friends in the town of Dover. Theirs are truly profiles in courage, and all of us owe them a debt that can never be repaid.

References


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